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Water, provision of: water must be provided for domestic consumption, industry, agriculture, transportation and other purposes in sufficient amounts and adequate quality (see Water).

For hygienic reasons, the favored source of drinking water is groundwater. In areas where there is little ground water, it must often be taken by filtration through riverbanks or from artificial reservoirs, and in some cases, the water must be taken from rivers. Process water is generally taken from surface sources, usually rivers. When the water is pure enough, it can be delivered directly to the consumers. In a few cases (high-altitude reservoirs and springs) it can be delivered by gravity flow, but usually it must be pumped. Intermediate reservoirs (such as water towers) are used to regulate the pressure. Transport is through underground pipes.

Water quality. drinking water and process water for the food industry must meet certain hygienic requirements. It may contain no pathogenic bacteria, and the number of other bacteria must be low. The number of bacteria (coliform bacteria) is given by the Colititer (see). Process water must have properties to match the requirements of its consumers, which are generally very speific (see Water treatment).

Water treatment: production of water of a quality suitable for use from surface or ground water. In general, W. is divided into treatment for drinking and industrial quality.

According to the World Health Organization, drinking water must meet the following qualifications: it must be free of pathogens and substances which can impair health; it must have a low bacterial content and be appetizing; it must be colorless, cool and free of foreign odors and tastes; it must not be too hard (see Hardness 2); and it must not attack materials or lead to deposits or incrustations, that is, it must be in Calcium-carbon-dioxide equilibrium (see).

Substance	mg/l
Iron	$\leq$ 0.1
Manganese	$\leq$ 0.05
Potassium permanganate consumption	$\leq$ 12.0
Ammonium	not detectable
Nitrite	not detectable
Lead	not detectable
Phenols	not detectable
Chloride	$\leq$ 250
Nitrate	$\leq$ 20
Sulfate	$\leq$ 250
Fluoride	$\leq$ 1.0

Water for industrial purposes must meet different specifications, depending on the use. For example, steam generators require water with no hardness, while textile plants, bakeries and breweries require soft water with no iron. Manganese must also be present in no more than traces. Cooling water must not produce deposits in the cooling system. The specifications for industrial water are sometimes very demanding (see, for example, Feedwater), and the problems of W. are so numerous that independent disciplines have arisen to treat them (e.g. feedwater chemistry). The qualities of crude water vary greatly, as do the requirements for treated water, and as a result many methods of treatment have been developed and tested on an industrial scale.

To achieve the desired quality of treated water, several processes are combined at each stage of treatment, and in each case, protection against corrosion, high technological and economic efficiency and optimum purification must be considered. The processes in turn often consist of several steps. The most important of the processes are: a) Gas exchange (see); b) removal of suspended particles and colloids by sieving, Sedimentation (see) and Filtration (see); c) removal of dissolved substances by Deferrization (see), Demanganization (see), Water softening (see), Desalination (see), chemical stabilization (see Protective layer formation), Deacidification (see) and Clarification (see) in the form of adsorption (see Sorption) or Oxidation processes (see); d) Groundwater enrichment (see) and e) Disinfection (see).

There are a number of other processes for certain substances, for extreme demands for quality or for extreme climatic or other conditions. These include Degasification (see), Evaporation (see), Oil removal (see), Silica removal (see), sea water Desalination (see), deactivation (see Sewage treatment) and Fluoridation (see).

Watson-Crick model: see Nucleic acids.

Wave function: see Atom, models of.

Waxes: originally a term for diverse mixtures of water-insoluble biological products in which the main components are esters of long-chain fatty acids with long-chain primary alcohols. W. often also contain a great variety of free acids (corresponding to the esterified acids), ketones, alcohols and limit hydrocarbons.

The modern concept arises from industrial use of W. and the extensive substitution of mineral and synthetic materials for natural products. W. are now considered to be substances and mixtures with certain technological properties: at 20°C they are malleable to brittle solids, with large to small crystals, are transparent to opaque, but not glassy, melt above 40°C without decomposition, and have relatively low viscosity a few degrees above their melting points. Their consistencies and solubilities are highly temperature dependent. If a substance displays these properties, it is considered a W. (in borderline cases, one of the above properties may not be completely present). It is a characteristic of W. that they not only consist of a large number of similar chemical compounds, but that compounds representing a number of chemical classes are present in them.

Economically, the most important W. is solid paraffin from petroleum (it accounts for more than 90% of the world production); in some countries, paraffin is still extracted from soft coal in significant amounts. For special applications or for production of certain compositions, natural products are chemically modified (mineral wax, fatty acid mixtures). W. may be completely synthetic (polyethylene, copolymers) or may be obtained from natural sources (e.g. candelilla, carnauba, and palm waxes, beeswax, shellac and wool waxes).

W. are used mainly to produce candles, protective coatings for floors, automobiles and leather; to impregnate paper, cardboard and fiberboard, and as bases for cosmetic and pharmaceutical products.

Hollings Freist

Wegscheider principle: a rul... ics: in parallel reactions (see Rea... ratio of the amounts of the vari... time is the same as the ratio of ... the steps which lead to their form... valid unless the parallel steps ha... rate equation, and the initial c... products are zero.

Weissenberg process: see X-... sis.

Weston standard cell: a Stan...

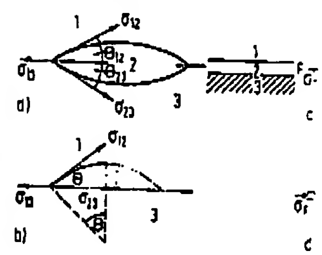
Wet metallurgy: same as Hyd...

Wet grinding: the grinding of ... or liquid suspension in a funnel. ...

Wetting: spreading of one liq... quid which is not miscible with ... surface. If a drop spreads over th... film, one speaks of *complete W.* ... quired of a glue. In *incomplete W.* ... (see) forms which corresponds to ... equilibrium. When a liquid sprea... other liquid or a solid, there are ... Either the spreading liquid is in e... surface of the substrate (Fig., a ... equilibrium with a spread film (... equilibrium states are defined as (...

a) $\sigma_{13} = \sigma_{12}\cos\Theta_{12} + \sigma_{23}\cos\Theta_{23}$,
b) $\sigma_{13} = \sigma_{12}\cos\Theta_{12} + \sigma_{23}$,
c) $\sigma_F = \sigma_{12}\cos\Theta_{12} + \sigma_{23}\cos\Theta_{23}$ an...
$\sigma_F = \sigma_{12}\cos\Theta_{12} + \sigma_{23}$,

where $\sigma_F < \sigma_{13}$. σ is the surface te... contact angle.



Changes in wetting are important in... tion, washing and layering process...

Wetting agent: a natural or sy... which reduces the surface tension o... liquid (see Surface active substanc... possible better penetration of liqu... faces, such as those of wood, meta...

Whisker, *hair crystal*: a needl... growth form of a crystal which ha... properties. W. are very thin (abou... meter) and may be up to several ... They are formed mainly by metals. ... conditions can also be formed by s... ionic substances. Because their ... tremely few defects, they can be ve... ample, they may be about 1000 tim... normal single crystal. They are use... with plastics or glasses to make new... rials.

and it requires calcium ions as cofactors. R. is a milk-coagulating enzyme; its only substrate is the milk protein κ-casein, which it converts to insoluble para-κ-casein (M_r 22,000) and a *C*-terminal glycopeptide (M_r 8000). The action of R. destroys the function of κ-casein as a protective colloid.

Repair enzymes: enzymes which are able to repair damage to DNA caused by chemicals or radiation. The damaged sections are cut out and replaced by the correct sequences. R. systems include DNA polymerases (see) and DNA ligases (see).

Repellents: substances used to drive off annoying or deleterious animals. There are Bird repellents (see). Deer repellents (see) and above all, Insect repellents (see).

Replication: see Nucleic acids.

Reppe chemistry: see Acetylene chemistry.

Reppe syntheses: see Acetylene chemistry.

Repulsion energy: the energy resulting from a close approach of two atoms or molecules with closed shells, as a result of the Pauli principle. The R. at a distance R is usually given by the expression $\varepsilon_{rep} = A/R^n$ (n = 9-12) or $\varepsilon_{rep} = Be \cdot CR$. Here A, B and C are experimentally determined constants. The R. is slight for large distances, but increases rapidly after R has decreased below a certain limit. It is the main factor determining the volume requirement of an atom or molecule.

Research octane rating: see Octane rating.

Resanes: highly unsaturated organic compounds found in natural resins.

Reserpine: see Rauwolfia alkaloids.

Reserves: in textile processing, a protective paste applied to the surface of cloth before it is dyed, to prevent coloration of that part of the surface which is covered. In *over-printing reservation*, the cloth is impregnated with dye solution, and subsequent application of the reserver prevents fixation of the dye. In *preprinting reservation*, the cloth is printed with a paste which prevents subsequent coloration of the printed areas, either chemically or physically. Resins, waxes and chemicals which convert the dye to an inactive form are used for preprinting reservation.

The best known R. is variamine blue reserve. After the cloth is treated with a naphthene compound, an acidic salt is printed onto it; when the cloth is later treated with variamine blue salt (a diazonium compound), coupling is prevented in the printed areas, because the coupling can occur only in an alkaline medium. Addition of vat dyes and sulfite to the printing paste is used to create colored reserves under the variamine blue; the diazonium compound of the variamine blue salt is reduced to a phenylhydrazine derivative which can be coupled. White and colored reserves are frequently used under aniline black. After the cloth is impregnated with aniline salt (aniline chlorohydrate) and dried, the white or colored reserve is printed on. Since aniline black forms by oxidation of aniline salt in a mineral acid medium, a white reserve can be achieved by printing on a reducing agent or an acid binder (sodium acetate, zinc oxide). Vat dyes are used for colored reserves.

Re/Si configuration: see Topic groups.

Resin: an organic solid or semisolid, usually amorphous and translucent and having a characteristic sheen. R. are characterized more by their similar physical properties than by their chemical similarities; they are supercooled melts, somewhat like glasses. They often consist of many similar substances with molecular sizes up to the macromolecular range. From this it follows that they do not have fixed melting points, but undergo a gradual transition from the liquid to the solid state. Pure R. have no odor or taste, are insoluble in water, but are soluble in ether, alcohols, various esters, essential and fatty oils and halogenated hydrocarbons such as chloroform and carbon tetrachloride. Most of them burn with bright, very sooty flames.

1) *Natural R.* can be classified on the basis of their chemistry, botanical sources or geographical distribution. Liquid R. or solutions of R. in essential oils are called *balsams*. Commercially, they are often named for their origin, e.g. Canada balsam (see), Peru balsam (see) or Japan lacquer. The natural R. are nearly all of plant origin (*tree resins, plant resins*) and are formed as such or mixed with terpentine oil or other oils, usually in the bark or trunks of certain trees, especially conifers (see Balata, Benzoin resin, Catechu, Dammar, Elemi, Sandarac, Tolubalsam, Gum resins). They may also be found in the fruits, e.g. bergamotte and Dragon's blood (see). The odor of these secretions is due to the oils mixed with the R.

Chemically, the natural R. are related to the terpenes and essential oils, and usually consist of complex mixtures of resinic acids, resin alcohols and phenols (resinols), phenols with tannin properties (resinotannols), highly unsaturated substances (resenes) and esters of resin acids. For example, the non-steam-volatile fraction of pine R. is a mixture of five isomeric diterpenes, of which abietic acid makes up the largest fraction.

The most important of the *fossil R.* is Amber (see); others are batu and Copals (see). The fossil R. are deposits which may have been created by the destruction of large forests.

Fresh R. are called recent R.; the balsam R. are the most abundant. These are obtained for the most part by artificial injury of conifers (secondary resin flow). Distillation of the crude balsam yields terpentine oil and, as a distillation residue after melting, colophony. The conversion products of natural rubber (see Caoutchouc) are also considered natural R.

The most important animal R. is shellack.

Many of the natural crude R. are first melted and filtered, then separated into various components by steam or vacuum distillation. They are used to make lacquers, varnishes, polishes, cosmetics, textile additives and drugs. As the production and variety of synthetic R. has increased, the natural R. have become less important.

2) *Synthetic resins* are organic products made from low-molecular-weight starting materials. These compounds are a type of plastic, and most are made by polycondensation. The most important are 1) Aldehyde resins (see), Ketone resins (see) and Ketone-aldehyde resins (see); 2) amidaldehyde resins, such as Sulfonamide resins (see), Dicyandiamide resins (see) and Urea resins (see); 3) Aminaldehyde resins, e.g. Aniline resins (see) and Melamine resins (see); 4) Epoxide resins (see); 5) Carbohydrate resins (see); 6) Hydrocarbon resins (see); 7) Phenol resins (see); 8)

Polyester resins (see): ‹
anes); and 10) Furan r
Resin acids, *resino*
resins; chemically the
phenylacrylic acids or
sins of gymnosperms
boxylic acids such as
acids (levo- and dextro
mostly triterpene acids
zoin, masticadienonoic
mastic, or boswellic ac
Aromatic R., formed
biosynthesis, are foun
response to injury or d
R. are called *resinates*
The R. are obtained
R. and terpenes. They
resins or resin alcohols.
of resin soaps, sizing,
so on.
Resinate: 1) *Resin s*
applications of these s
Alkali resinates are m
ophony, which consists
alkali hydroxide or car
ded in small amounts
solubility and foaming
should contain little
make the soap sticky
pounds with the calciu
water; these readily
laundry. The name resi
ture of fat and resin s
than alkali are used in
2) *Resin ester:* usu
taerythritol ester of a
components of paints.
Resinite: see Macer
Resinol: a basic con
sisting of resin alcohol
Resinol acids: same
Resin soap: see Re
Resistance breaker
vent or reverse the de
ticides in the target sp
ticides (see), Acaricid
acts as a selective fac
which are less suscept
descendents of those
population. An exampl
chlorobenzene, which
teract DDT resistance
Resitol: see Phenol
Resmethrin: see Py
Resol: see Phenol r
Resonance: a theo
Robinson and Ingold
(1924) to explain bon
localization of double
does not satisfactorily
ground state of these
superposition of all
mulas (*canonical or li*
cal structures do not re
molecule, but are onl
true electronic structur